U.S. PATENT APPLICATION

for

SPRINKLER SYSTEMS

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SPRINKLER SYSTEMS

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application claims priority under 35 U.S.C. § 120 to U.S. application No. 10/104,055 filed March 25, 2002, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] Field Of The Invention. The present invention relates to sprinkler systems, preferably made from an injection molded plastic material.

[0003] Sprinkler systems are known in the art. However, until recently, safety regulations have required them to be made of metal. That is, in the past, safety regulations for sprinkler systems required they be run in steel pipe, using metal sprinkler systems having metal trigger mechanisms. In addition, sprinkler systems had to be installed by licensed installers. These old safety regulations made installation very expensive and prohibitive for residential use in everything but the largest houses. With new safety regulations, however, sprinkler systems can now be run in plastic pipe.

SUMMARY OF THE INVENTION

[0004] One object of the invention is to overcome the disadvantages of the known art described above. Another object of the invention is to provide a cost-effective method of adding a sprinkler system to a residential, commercial or light commercial building. Yet another object of the invention is to provide an inexpensive, injection-molded plastic device, that can be made from a number of different plastics, with a number of ways to turn a sprinkler system on. Still another object of the invention is to provide a sprinkler that is simple and dependable. Yet another object of the invention is to provide a sprinkler that is aesthetically pleasing. Yet another object of the invention is to provide a sprinkler where components are easily replaceable.

[0005] In order to achieve the foregoing and further objects, there has been provided according to one aspect of the invention, a sprinkler, preferably formed by an injection molding process, that includes a molded plastic body portion made of an injection molded plastic having a substantially hollow central portion for allowing water to pass

therethrough, the hollow portion extending from a distal end to a proximate end of the molded plastic body; a diffuser head portion preferably located in the vicinity of the distal end of the hollow central portion; a sealing portion made of an injection molded elastomeric material in proximity to the hollow central portion; and a link portion. When the link reaches a predetermined temperature the link portion is activated to start the flow of water out of the sprinkler.

[0006] In one preferred embodiment, the diffuser head portion is rotatable. In another preferred embodiment, the sealing portion is located in the vicinity of the proximate end of the hollow central portion. The sealing portion can be mounted on an insert that can be inserted into the sprinkler system with threads or with tabs. Preferably, the insert and the sealing portion are formed in a multi-shot injection molding process.

[0007] According to another aspect of the invention, there has been provided a sprinkler system that includes: a sprinkler as described above; at least one conduit adapted for transporting water from a water source to the sprinkler; and a connector for joining the hollow portion of the body portion with the at least one conduit.

[0008] According to another aspect of the invention, there has been provided a sprinkler formed by a two-shot injection molding process that includes a molded plastic body portion comprising an injection molded plastic having a substantially hollow central portion for allowing water to pass therethrough, the hollow portion extending from a distal end to a proximate end of the molded plastic body; a diffuser head portion comprising an injection molded plastic and located proximate to the distal end of the hollow central portion, wherein one or both of the molded plastic body or diffuser head portion is formed in a first shot in a multi-shot injection molding process; a sealing portion made of an injection molded elastomeric material in proximity to the hollow central portion, the sealing portion is formed in a second shot in a multi-shot injection molding process; and a link portion. When the link reaches a predetermined temperature the link portion is activated to start the flow of water out of the sprinkler.

[0009] According to yet another aspect of the invention, there has been provided a method for forming a sprinkler described above by a two-shot injection molding process that includes providing a first mold configured in the shape of a molded plastic body portion, or providing a first mold configured in the shape of a diffuser head portion; injection molding, as a first shot, a first plastic material into the first mold to form a body portion or a diffuser

head portion; providing a second mold configured to provide, with the body portion or diffuser head portion, a void having a cross sectional area bounded by the body portion or diffuser head portion and the second mold surface; injection molding, as a second shot, a material into the void to form a sealing portion; and providing a link portion, wherein when the link reaches a predetermined temperature the link portion is activated to start the flow of water out of the sprinkler.

[0010] A sprinkler system is also provided. The sprinkler system desirably includes a sprinkler having a body portion defining a substantially hollow central portion for allowing water to pass therethrough. The hollow central portion extends from a distal end of the body portion to a proximate end of the body portion. The sprinkler system also includes a housing connected to the sprinkler. The housing includes at least one outer wall and a cover portion transverse with the at least one outer wall which defines an interior space. The sprinkler can be at least partially located within the interior space.

[0011] In embodiments of the sprinkler system, the housing can be integral with the sprinkler, or removably connected to the sprinkler. The housing can also include a lip, which outwardly extends from the distal portion of the outer wall that is opposite the cover portion. The at least one outer wall can also define at least one opening. The at least one opening typically has a first face and a second face, and an engagement portion adjacent to the first face of the at least one opening. The engagement portion may be directly adjacent the opening, or adjacent to the plane of the first face of the opening but a distance from the opening. The engagement portion generally does not extend the entire length of the opening.

[0012] The sprinkler system, including the sprinkler and housing, are preferably molded, and more preferably injection molded. These components may be injection molded from a wide variety of materials including resins, plastics, and metals.

[0013] The sprinkler can also be of the type previously described. The body portion of the sprinkler can include a diffuser head portion located in the vicinity of the distal end of the hollow central portion, a sealing member made of an elastomeric material in proximity to the hollow central portion, and a link portion. When the link reaches a predetermined temperature, the link portion is activated to start the flow of water out of the sprinkler.

The link portion may be activated by melting, softening, breaking, or by other activation methods.

[0014] The housing of the sprinkler system may include one outer wall that is generally circular or oval in shape. Alternatively, the housing may include a plurality of outer walls to provide a polygonal shaped housing, such a squared or rectangulared housing.

[0015] Also provided is a sprinkler housing that includes at least one outer wall, and a cover portion transverse with the at least one outer wall which defines an interior space. The at least one outer wall defines at least one opening having a first face for engaging an object applying force against the housing in a first direction, and a second face for engaging an object applying force in a second direction. The housing can further include an engagement portion adjacent to the first face of the at least one opening for engaging an object applying force in a third direction. In one embodiment, the first direction may be counterclockwise, the second direction may be clockwise, and the third direction may be a direction perpendicular to the first and second directions.

[0016] The object used to apply force against the housing is a sprinkler device. The device includes a distal end, a proximal end, and at least one tab extending from the proximal end for operable engagement with the at least one opening of the housing. The at least one tab is desirably configured to engage the first face, the second face and the engagement portion of the housing. This will permit the tabs to rotate the housing, and lull or push the housing using the device. The device can be configured so that the distal end can be removably coupled with a handle. The device can also be circular and hollow in nature so that it may fit over the sprinkler when located within the housing, or it may be shaped in other ways such as, but not limited to, a U-shaped configuration to allow the device to extend over the sprinkler to engage the housing.

[0017] The sprinkler housing and the device may be made by molding a material by the application of heat and pressure in the form of the housing or device, and solidifying the material. Many alternative molding methods may be used, but the desired method of molding is injection molding. Likewise, a wide variety of moldable materials may be used including resins, plastics, and metals.

[0018] Further objects, features and advantages of the present invention, will become readily apparent from detailed consideration of the preferred embodiments which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Figures 1a-1e depict a sprinkler according to a preferred embodiment of the invention.

[0020] Figures 2a and 2b depict a sprinkler according to another preferred embodiment of the invention.

[0021] Figures 3a and 3b depict a sprinkler according to another preferred embodiment of the invention.

[0022] Figure 4 depicts a sprinkler system according to another preferred embodiment of the invention.

[0023] Figure 5 depicts the body portion of the sprinkler according to another preferred embodiment of the invention.

[0024] Figure 6 is an isolated view of the sealing system to another preferred embodiment of the invention.

[0025] Figure 7 depicts a sprinkler according to another preferred embodiment of the invention.

[0026] Figures 8a and 8b depict a sprinkler according to another preferred embodiment of the invention.

[0027] Figure 9 depicts a sprinkler system according to another preferred embodiment of the invention.

[0028] Figures 10a and 10b depict a replaceable seal according to a preferred embodiment of the invention.

[0029] Figure 11 is a top view of the top of diffuser head portion according to a preferred embodiment of the present invention.

[0030] FIGS. 12a-12c depict a sprinkler system in accordance with another embodiment of the invention as described herein.

[0031] FIGS. 13 depicts a device for installation, removal, and/or maintenance of a sprinkler system in accordance with the teachings described herein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] The present invention provides an inexpensive, preferably injection-molded plastic device, that can be made from a number of different plastics, with a number of ways to turn a sprinkler system on. The sprinkler head is made of a suitable plastic, preferably formed by an injection molding process. The sprinkler includes a molded plastic body portion **10** preferably made of an injection molded plastic having a substantially hollow central portion **11** for allowing water to pass therethrough. The hollow portion extends from a distal end **12** to a proximate end **13** of the molded plastic body portion **10**. The body portion **10** can be made of any suitable plastic, preferably a heat resistant plastic, such as polyacetal, sold under the trade name, Delrin™, polysulphone, nylon and other well known heat resistant plastics. The body portion **10** preferably is made by an injection molding process, in particularly, a multi-shot injection molding process described more fully below.

[0033] The sprinkler also includes a diffuser head portion **16** located in the vicinity of, and preferably adjacent to, the distal end **12** of the hollow central portion **11**. The diffuser head portion **16** functions as a water diffuser to spray water in a desired pattern. The materials of the diffuser head portion **16** can be the same or different as the body portion, and preferably are the same. The sprinkler also includes a sealing portion or member **14** that is made of an injection molded elastomeric material in proximity to the hollow central portion. The sealing portion **14** or member can be made of any material capable of forming a sealing fit between the body portion and diffuser head portion or between the body portion and the retainer portion **15** (Figure 1).

[0034] Also included is a link portion **25**. The link portion **25** is constructed such that when the link reaches a predetermined temperature, the link portion is activated to start the flow of water out of the sprinkler diffuser head. The link portion can be a lead-meltable link that would melt at about 165 °F. The link portion may also be a "mousetrap-type" device that has a bimetal link, or a memory metal link, such as nitinol, that deflects at a given temperature, allowing the link portion to activate the sprinkler system. In another embodiment, the body portion **10** also may include an extension or projection shown as **21** in Figures 1 to 3, that acts to support the link **25**.

[0035] According to one preferred embodiment, there is provided a retainer **15** (shown only in Figure 1) that forms a water tight seal with the body portion along with the elastomeric material. This embodiment is described in more detail below.

[0036] Between the body portion **10** and the diffuser head portion **16** or retainer **15**, a sealing member **17** is positioned. The sealing member provides a water-tight seal, when the sprinkler is not in use, to protect against leakage.

[0037] As stated above, a goal of this invention is to make the sprinkler as simple and dependable as possible. Along those lines, the applicant has found that a multishot injection molding process is especially suitable. Multi-shot processes, *per se*, are known in the art, and examples can be found in "Injection Molding Alternatives: A Guide for Designers and Product Engineers," Section 5.5: "Multicomponent Molding" by Jack Avery (Hanser Gardner Publishers, 1998, pages 113-117); "Process Selection For Multi-Shot Molding" by Mike Tolinski (Molding Systems, volume 56 number 1, Jan 1998, p 30-35); "Multi-Shot Values" by P. Coates, (Plastics and Rubber Weekly, No.1789, 4th June 1999, p.7); "Case Study for Multi-Shot" by J. Hahn, (Antec *99 Conference Proceedings, New York City, 2nd-6th May 1999 p.406; and "Multi-Shot Injection Moulding" by J. Tinson, (Med.Device Technol., No.3, April 1998, p.26-8), all of which are incorporated by reference their entireties.

[0038] In a typical multi-shot process, the object to be molded is made from more than one material. A first material is injected into a first mold to form a first molded object. The first molded object is then removed from the first mold, and inserted into a second mold, typically by rotating the movable portion of the mold from the first mold to the second mold, into which a second material to be molded is injected to form the final molded object. The final molded object is thus a combination, e.g., laminate, of the first and second materials. Additional analogous molding steps using third, fourth and additional materials can also be employed. These steps preferably all occur within the same molding cycle.

[0039] If a multi-shot injection molding is used in the present invention, the body portion **10** and/or diffuser head portion **16** preferably is formed in a first mold. According to this embodiment, a suitable plastic is injected into the mold to form the body portion and/or diffuser head portion. The body portion and/or the diffuser head portion then is removed from the first mold and moved into position with the second mold. The second mold and

the body portion and/or the diffuser head portion form a cavity in the shape of the sealing portion. The elastomer forming the sealing portion is then injection molded into the cavity to form the sealing portion.

[0040] Afterwards, the composite body and/or diffuser head portion and sealing portion are removed from the second mold. If the body portion or the diffuser head portion was formed separately, the composite can then be fitted with the body portion and/or diffuser head portion, either before or after installation. The link is then added to form the sprinkler.

[0041] The present invention will now be described with reference to the non-limiting embodiments described in Figures 1-13.

[0042] Figures 1a-e show a molded hard plastic body portion with a hole through the center of threaded area **18**. The hole (*i.e.*, hollow central portion **11**) through the center of the molded area, through which the water runs, will have at its bottom a sealing portion elastomer, preferably formed from a second-shot injection molding process, to seal the central portion **11** and to help insure against leakage. In this embodiment, the sealing member is a soft, pliable elastomer that does not hold the water pressure. It is thus supported up by retainer **15** that can be held in place with a fusible link **25**, usually a metal link that melts at about 165 degrees F. The retainer **15** can be made out of metal or plastic, whichever is the most efficient and economical. The retainer can be made to stay attached or to fall free when the water pressure causes it to open.

[0043] The body portion preferably has a slot **19** in which to snap in the diffuser head portion **16** water diverter that hangs below the center of the threaded area. The diffuser head portion diverter will be arranged to cause the water to divert in a uniform manner to cover the area that the sprinkler is designed to sprinkle.

[0044] The sprinkler is activated when the fusible link **25** is activated, such as by melting. The retainer will be dropped, or forced, out of position by the water pressure, causing the sealing member to deflect and then burst as the retainer drops away. The water then flows freely in the diverter and is spread (sprinkled) around the room.

[0045] The sprinkler may be a factory-molded part. The body portion would preferably be replaced with the sealing member in it after each activation. This would help assure a good seal and a uniform device for increased dependability. In a preferred embodiment, to replace the sealing member, the plastic body portion **10** is unthreaded from the sprinkler

system. A new plastic body portion with sealing member **14** is then threaded into the sprinkler system, the diffuser head **16** is replaced and the retainer portion with a link portion is put back into position.

[0046] Figures 2a-b show another preferred embodiment. The sprinkler in Figure 2 has a moveable diffuser head portion **16**. In this embodiment, the sprinkler diffuser head portion **16** can be retracted back up into the body portion **10**, and is held in place with a link portion, such as a fusible pin. As Figures 2a-b depict, a sealing member **17** is located between the diffuser head and the body portion to form a water tight sealing relationship. When the heat reaches the temperature to activate the link portion, such as by melting the fusible pin, the diffuser head **16** drops down a sufficient distance, preferably about two inches, releasing the seal, and turning the water on within the sprinkler. The sprinkler according to this embodiment may be reusable. To reset the sprinkler, one would push the diffuser head back into location and put in a link member, such as a new meltable, or fusible, pin, and it would be resealed.

[0047] As noted above, one object of the invention is to provide a more aesthetically pleasing sprinkler. This is accomplished by the embodiment shown in Figures 2a-b in that the sprinkler is substantially mounted flush with the ceiling and is thus significantly less obtrusive and noticeable.

[0048] In Figures 2a-b, the hard plastic threaded body portion may be a smooth, glued-together body. In this case, the threaded body has projection **21** with a hole in it for receiving a link portion, such as a meltable pin. The diffuser head portion in this embodiment has an extended shaft or portion **20** that has a stop **22** at the top, and a sealing member **17** in the form of an O-ring seal at the bottom. The stop includes radially extending members **22a**. The O-ring sealing member is pushed up into the threaded body and then retained there by putting a pin through the threaded body under the diffuser.

[0049] The water pressure pushes down on the O-ring seal, which can be molded in a multi-shot injection molding as part of the diffuser head portion **16**. The fusible portion that keeps the diffuser in place also holds the O-ring seal in place because it is all one body. When the fusible portion is activated, such as by melting, the water pressure will force the O-ring seal and the diffuser in a downward direction. This mechanism will fall until the stop hits the bottom of the threaded body retainer. At that point, full water pressure comes from the threaded body portion **10**, and the stream will hit the diffuser head

portion **16** and be diffused around the room in the area to be sprinkled. As noted above, in this embodiment, the threaded body portion **10** is substantially flush with surface of the ceiling, such that the diffuser head portion is held in place at the surface of the ceiling, thus making it aesthetically less noticeable obvious than a normal sprinkler system. However, when the link is released, it will drop down to the predetermined extended shaft length on the diffuser and operate as a normal suspended sprinkler system.

[0050] According to another embodiment of the application as shown in Figures 4, 7, 9 and 11 the diffuser head portion **16** has a stop **22** with radially extending members **22b** that are angled and preferably elongated in the longitudinal direction. Upon activation, the diffuser head portion drops down as described above. When the flow of water strikes the angled members **22b**, the diffuser head will rotate and assist in dispersing the water, particularly in the area close to the sprinkler. Figure 11 shows a top view according to this embodiment.

[0051] Another alternative embodiment is shown in Figures 3a-b. In Figures 3a-b, the link portion is a bimetal or nitinol trigger mechanism. It can be used in the embodiment shown in Figures 1, 2, 4, 7, 8 and described above and below. For example, if it is configured in a manner similar to Figure 1 (not shown), it would be the second-shot molded sealing member and retainer portion as described with reference to Figure 1. The link portion would be like a trigger mechanism having a short, post-like strip of either bimetal or nitinol, shown as **25** in Figures 3a-b. The trigger mechanism would pop out like a mousetrap and allow the retainer portion that is holding the sealing member in place to be released. The sealing member would then blow off, and the water would be distributed by the diffuser head portion that is snapped in underneath it.

[0052] If this embodiment is constructed in a manner that is similar to Figures 2a-b (as shown in Figures 3a-b) or e.g., figure 4, the threaded or tabbed body portion **10** includes a longer projecting member **21** that receives a bimetal, or memory metal, activating rod that is wedged between the diffuser head portion **16** and the end of the projection **21** of the threaded body portion **10**. When a temperature reaches a predetermined set point, the bimetal, or memory strip, deflects, causing the bottom end to kick out, which will cause the diffuser head portion to drop due to gravity and water pressure and the water will begin to flow.

[0053] The diffuser head portion **16** can be made in various ways to cause the water flow to spread a desired amount depending on the room size and the sprinkler rating. It will also

need to accommodate normal household water pressures that may be lower than a normal sprinkler water pressure.

[0054] In another preferred embodiment shown in Figures 4, and 7-9, the body portion **10** is not required to be threaded into the sprinkler system. Instead, the body portion can include tabs **31** that can be inserted into slots in the sprinkler system **50** and rotated to lock the body portion into place in the sprinkler system **50**. Figure 5 shows ¼ turn lock slots **32** according to a preferred embodiment. Figure 7 depicts the body portion **10** with tabs **31** before insertion into the sprinkler system.

[0055] The sprinkler system can include a support **40**, preferably made of metal, that is connected to the rest of the sprinkler system **50** having hollow portions **51**, as shown in Figures 4, 5 and 9. While the metal support is shown as having slots for receiving the tabs **31**, the metal support can also have threads instead of slots for supporting body portions that are threaded such as those embodiments shown in Figures 1 to 3.

[0056] In embodiments where the body portion **10** is held by a locking tab and slot, it may be somewhat more difficult to nest the proximate portion **13** of the body portion **10** against the sprinkler system **50**. In these "threadless" embodiments, it is preferable to have an additional sealing member **60** that is located at the interface of the proximate end **13** of the hollow central portion **11** of the body portion and the sprinkler system **50**. This additional sealing provides a water-tight seal between the proximal end **13** of the body portion **10** and the sprinkler system **50**. This additional sealing member is preferably replaceable. This can be in lieu of or in addition to the sealing member **14** or **17** located at the interface of the distal end **12** and the diffuser head portion **16** or retainer **15**. Figure 4 shows an embodiment with seal **17** and Figures 8-9 show embodiments with no sealing member between distal end **12** and diffuser head portion **16**.

[0057] In a preferred embodiment, the additional sealing member **60** includes two components, a seal **61** and a support surface **62**. The seal can be made of a thin elastomeric material, such as the material forming sealing portion **14** that can deflect and burst by the water pressure in the sprinkler system **50**. To support the seal **61** before activation, a support surface **62** is provided, that is preferably coextensive with the area of the hollow central portion **11** of the body portion **10.** See, e.g. figure 8a. In a preferred embodiment, the support surface **62** is a split cover as shown in Figures 4, 5, 8 and 9. In particular Figure 8a shows a top view of the split cover **62** with score **63**. Figure 8b shows

split cover in both the intact and a ghost view of one half of the split cover after activation. In an alternative embodiment shown in Figure 12a, the seal **61** is supported by the top ***22c*** of stop **22** of the extended shaft **20**.

[0058] Before activation, the support surface **62** is supported by the top **22c** of stop **22** where it is held place by link portion **25**. Upon activation, the stop **22c** can no longer support the support surface. As a result, the water pressure in the sprinkler system ruptures the seal and the support surface allowing water to be dispersed by the diffuser head portion.

[0059] In one preferred embodiment, the seal can be mounted on a threaded insert **70** for ease of replacement as shown in Figure 10. To reset the sprinkler head after activation, the body portion **10** is removed by aligning the tabs **31** with slots **32** to remove the body portion and diffuser head. The threaded insert **70** with seal **61** is then unscrewed and replaced with a new insert with an intact seal. A new supporting surface **62** is placed over the body portion and the body portion is inserted back into the slots of the sprinkler system and twisted into place.

[0060] In another embodiment, the seal **61** is mounted on a tabbed insert **80**. In this embodiment, the insert **80** uses locking tabs **82** to hold the seal **61** in position before activation. An additional seal, such as an O-ring **81** is used to provide a water-tight seal between the insert **80** and the remainder of the sprinkler system **50**. Thus, instead of screwing in the insert for replacement of the seal **61**, the insert is simply pushed in and twisted into place.

[0061] In both of these embodiments, the insert and seals **61** and/or O-ring seal **81** can be made by a multi-shot process as described above.

[0062] In a separate embodiment, the sprinkler system includes a housing **41**, preferably made of a plastic and being integral with the plastic body portion **10**, as shown in Figures 12a-c. While the housing **41** and plastic body portion **10** are preferred to be one plastic entity (e.g., an integral injection-molded fire sprinkler system), the housing **41** can be made of a material different from the body portion **10**, and may also be separate from the body portion **12**. Under these circumstances, the housing **41** may be connected to the plastic body portion **10** by methods known in the art (e.g., adhesive, fasteners, couplings). The housing **41** allows the sprinkler to be retracted within the housing as shown in Figures 12a and 12c, to provide an aesthetically pleasing appearance. The housing **41** can also include a lip **42**, allowing the sprinkler to be mounted substantially flush with the ceiling

(not shown) to make the fire sprinkler system significantly less obtrusive and noticeable. The lip **42** also conceals any gaps, spaces or other defects between the mounting surface and the fire sprinkler system, which often result from irregular cuts in the ceiling tile or finished surface. The housing **41**, as well as the sprinkler system, can also be colored to blend or match with its surroundings and be more aesthetically appealing.

[0063] As discussed, the housing **41** can be connected to or integral with the plastic body portion **10** of the sprinkler, and the housing **41** can also be utilized to install and remove the sprinkler system. In such embodiments, it is preferable that the housing **41** include a distal circumference **43,** from which the optimal lip **42** may outwardly extend. The housing **41** also preferably includes a proximal circumference **44** adjacent to the housing cover portion (e.g., cap) **45** which desirably encloses the cavity formed by the housing wall. The proximal circumference **44** can include tab openings **46** for use with a device for installing, removal, and/or maintenance of the sprinkler system. In the preferred embodiment, the housing is circular, but the housing may be any shape including rectangular so long as a sprinkler can fit therein.

[0064] A device **75** useful for such applications is shown in Figure 13. The device **75** may be considered a tool to remove or install sprinkler systems that are connected to the water supply by tabs or threads. The device **75** has a distal end **76** that can be connected to handles of various lengths. For example, in one embodiment the device's distal end **76** can be connected to a short handle for easy installation or removal when in near proximity to the sprinkler system. In other embodiments, the device may be connected or coupled to an extension handle at the distal end **76** for easy installation or removal of the sprinkler system from ground level or other distance. Figure 13 shows a preferred embodiment of the device **75** as being a hollow cylindrical tool (various handles not shown), although the device may take other forms.

[0065] The device **75** also includes a proximate end **77** with one or more tabs **78** that extend therefrom. In one embodiment, the proximate end **77** is circular, open-ended, and has a diameter to fit within the housing **41.** Desirably, the tabs **78** extend from the proximate end **77** a sufficient distance to engage the openings **46** of the housing **41** when inserted therein. When the preferred embodiment is inserted for use, the proximate end **77** slides over the sprinkler system's diffuser head portion **16** until the proximate end's surface

77a reaches the backside of the cap **45a** and fits within the proximate circumference **43** of the housing **41**. The tabs **78** then fit within the tab openings **46**. Figure 12b shows that the tab openings **46** are designed such that the tabs **78** fit within the tab openings **46** differently when the device **75** is being used to install the sprinkler system than when it is being used to remove the sprinkler system. When the device **75** is being used to install the sprinkler system, the tabs **78** slide into the tab openings **46** and any clockwise torque on the sprinkler system tool **75** engages a first face of the opening and allows the entire sprinkler system to be turned clockwise for tightening of threads or tabs **31.** Any force towards the distal end **76** during installation allows the device **75** to be drawn away from the sprinkler system without being attached to the sprinkler system. For sprinkler system removal, the tabs **78** also slide into the tab openings **46,** but the tab opening is designed such that any counter-clockwise torque against the housing will engage a second face of the opening to loosen the sprinkler system. Any force towards the distal end **76** of the device **75** when loosening the system will engage the engagement portion **49**, permitting the housing **41,** together with the sprinkler head, to be pulled away from the ceiling. Other embodiments of the device can be appreciated by the teachings herein. A non-exhaustive example is a device that does not include a cavity that encloses the sprinkler when in use, such as a U-shaped device with two arms extending from the distal end, each arm having a tab for insertion into the tab openings. Further, the housing and device may have only a single mating tab and tab opening.

[0066] The sprinkler system, including the sprinkler and the housing, as well as the device, may be manufactured by a molding process. Preferably, the components of the sprinkler system and device are molded by an injection molding process where moldable material, such as a plastic, metal or other resinous material is injected within a mold using heat and pressure. The material is then solidified, generally by a cooling process, although chemical setting agents may also be used in some embodiments.

[0067] While a number of preferred embodiments of the present invention have been described, it should be understood that various changes, adaptations and modifications may be made therein without departing from the spirit of the invention and the scope of the appended claims. As used herein and in the following claims, articles such as "the," "a" and "an" can connote the singular or plural.